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Man's Health: The Past and the Future

These discussions are selected from the weekly staff conferences in the Department of Medicine, University of California, San Francisco. Taken from transcriptions, they are prepared by Drs. David W. Martin, Jr., Professor of Medicine, and James L. Naughton, Assistant Professor of Medicine, under the direction of Dr. Lloyd H. Smith, Jr., Professor of Medicine and Chairman of the Department of Medicine. Requests for reprints should be sent to the Department of Medicine, University of California, San Francisco, San Francisco, CA 94143.

DR. SMITH:* *At Medical Grand Rounds we usually focus on a single disease or on a new area of technology to summarize in a coherent form our current knowledge of that subject. This discussion will be different. We have asked Professor Thomas McKeown to discuss his concepts of health and disease and the role of physicians in society.*†

DR. MCKEOWN:‡ In this discussion of man's health I would like to (1) outline a concept of the determinants of health and disease, (2) examine past changes in health in relation to these determinants, (3) consider future prospects for control of disease and (4) comment on the role of medicine in general and of clinical medicine in particular in the light of these conclusions.

Because assessment of past achievements and future prospects is likely to be affected considerably by an underlying concept of the determinants of health, I will begin by evaluating certain influences that have led to disease.

- Until the last 300 years (only about one ten-thousandth of his total existence on earth) man was subject to rigorous natural selection. Much earlier, during the nomadic period of human evolution many a conceptus died before birth and many did not survive to reproduce. Man is therefore well adapted to the environment in which he evolved—that of the nomadic period.

- Only a small part of the burden of disease is determined irreversibly at fertilization by genetic or chromosomal abnormalities. Most diseases, including the common ones, result from adverse environmental influences in combination with genetic characteristics that make the development of a particular disease more or less likely but not inevitable.

- The adverse influences are of two kinds: deficiencies and hazards. Of the four essential elements for sustaining life—food, water, oxygen and heat—only food has been seriously deficient. The common hazards have resulted from other living things competing for existence, microorganisms and predators, especially human predators.

- Under the conditions of evolution, basic requirements for health were provision of food and protection from the hazards presented by other living things. Changes in the environment from those conditions under which man evolved

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create new hazards, resulting from exposure to influences to which man's genes have not adapted.

In light of these conclusions, I will review the determinants of health in the past and, by classifying the residual health problems of developed countries, I will attempt to narrow the area of disagreement about which influences are likely to be important in the future.

The Past

There are many ways in which the history of man's health might be classified. Perhaps the most instructive is by dividing it into three periods—nomadic, agricultural and transitional—each being characterized by profound differences in living conditions and in the nature of its predominant disease problems.

The Nomadic Period

Mankind lived as nomads until relatively recently in human history, dependent on hunting, fishing and gathering fruit for food. Levels of fertility and mortality of man at that time are unknown, and it is questionable whether observations made on the few peoples who have retained a primitive way of life to the present can throw new light on these issues. However, because the population increased very slowly it can be inferred that mortality was high; it took about 3 million years for the human population to reach its first billion (in 1830); the second was added in 100 years, the third in 30 and the fourth in 15 years.

The causes of death can be divided into two broad categories: those for which man was responsible (all forms of homicide, particularly infanticide and tribal war) and those for which he was not directly responsible (food deficiency and injuries arising from hunting and gathering). On the evidence available or likely to become available, it is impossible to assess the relative contributions of these causes of death which, no doubt, varied from one population to another and from time to time. What is evident is that all of these causes are related to the environment and, particularly, to food supplies. For if homicide was common it was probably determined by limitations on resources; and if starvation or disease associated with food deficiency was important, it resulted even more directly from lack of food.

In relation to man's later health history it is important to note that infectious disease is not a common cause of death of wild animals.[1] The same was probably true of early man, for although he doubtless suffered from infections contracted from animal vectors, because he lived in small groups he was unlikely to have experienced many of the diseases which were later prominent, particularly those that are airborne.[2] The propagation and transmission of organisms responsible for these infections require large numbers in close contact; in the case of measles, for example, it has been estimated that a population of about 900,000 is needed to maintain the disease.[3]

I propose that for early man the main causes of sickness and death were food deficiency and hazards from other human beings competing for the same means of existence. The threat presented by microorganisms was relatively less important.

The Agricultural Period

There have been two major changes from the living conditions of early man and both have had profound effects on health and population growth. The first occurred with the transition from a nomadic to a settled way of life about 10,000 years ago; the second is associated with the agricultural and industrial developments of the last three centuries.

The first agricultural revolution brought about an improvement in food supplies that led to a decline of mortality and an increase in numbers. This expansion and aggregation of populations created the conditions required by many microorganisms to flourish, and infection became the predominant cause of death. However, population growth was uncontrolled and numbers increased to the point where resources became marginal again and, thus, the relationship between man and the organisms that caused disease developed while man was, in general, poorly nourished. The relationship was unstable and finely balanced according to the physiologic state of host and parasite: improvement in nutrition would tip the balance in favor of man and deterioration in favor of the parasite. In these circumstances, an increase in food supplies became an essential condition for substantially reducing mortality from infectious disease, and limitation of numbers would have to follow if the reduction was to be permanent.[4]

Thus, the predominant causes of sickness and death in the agricultural period resembled those of the nomadic period in that food deficiency was still critical, but differed in that microorganisms

rather than man himself presented the main threat. This change resulted from the expansion and aggregation of populations—a departure from the conditions under which man had evolved —and was aggravated by defective hygiene.

The Transitional Period

The period since the turn of the 18th century has been one of change, from an agricultural to an industrial way of life. In some countries the transition has been largely accomplished while in others it has scarcely begun. In developed countries there have been profound changes in economic conditions, from poverty to affluence, and in the character of disease problems, from infectious to noncommunicable diseases. In developing countries poverty still prevails and infections remain the most common cause of death. Hence, in the transitional period there is a mix of health problems, both within countries and between countries, and problems that were predominant in the past exist side by side with those that will become more significant in the future.

The first and most important reason for the decline of infectious diseases has been an improvement in nutrition resulting from continued advances in agriculture since the end of the 17th century. Initially, the advances were due to a more effective application of traditional practices and to the introduction of new crops, particularly the potato and maize, rather than to new methods associated with industrialization. However, from the second half of the 19th century agricultural productivity has been greatly increased by mechanization and the use of chemical fertilizers and pesticides.[4]

Second only to nutritional influences in time and, probably, in importance are the improvements in hygiene that have been introduced since the late 19th century. For example, better hygiene is the main reason for the decline of water- and food-borne diseases associated with a fifth of the reduction in mortality from all causes between the mid-19th century and the present in England and Wales. The first advances were in purification of water and disposal of sewage, but from about 1900 they have been greatly extended to include food hygiene, affecting most critically the quality of milk. Control of the environment has, of course, been advanced further in this century by improvements in working and living standards (including such measures as reduction of atmospheric pollution) affecting the community at large as well as domestic conditions.

Except in the case of vaccination against smallpox (associated with less than a 2 percent reduction in the death rate in England and Wales from the mid-19th century to the present) it is unlikely that individual medical care had a significant effect on mortality from infectious diseases before the present century. Between 1900 and 1935 progress was made in controlling infections, such as use of antitoxin for treating diphtheria and salvarsan for syphilis; intravenous fluid replacement therapy for diarrheal diseases; passive immunization against tetanus; improved surgical procedures for treating appendicitis, peritonitis and ear infections, and better obstetric care for the prevention of puerperal fever. But even if these measures were completely responsible for the decline in mortality from these conditions after 1900, which clearly they were not, they would still account for only a small part of the decrease in number of deaths that occurred before 1935. About that time the first powerful chemotherapeutic agents, sulphonamides and, later, antibiotics came into use; both have since been supplemented with improved vaccines. However, use of these early chemotherapeutic agents was not the only reason for the continued fall in mortality. I conclude that immunization and treatment contributed little to reducing mortality from infectious diseases before 1935, and since the practice of registering the cause of death was begun (1838) they have been less important than other influences.[5]

The other major reason for the modern transformation of health has been the change in reproductive behavior which has resulted in a decline in the birth rate in industrialized nations. The importance of this change can hardly be exaggerated. In England and Wales, for example, if the birth rate had continued to rise at its earlier pace the population today would be about 140 rather than 50 million—the effects on health and welfare can be imagined. While initial progress in improved health conditions was due to other influences, the change in reproductive behavior to restrict numbers was an essential complement, without which other advances, such as those associated with the first agricultural revolution 10,000 years earlier, would soon have been reversed.

If we categorize improvements in nutrition and hygiene as environmental factors, the influences most responsible for the decline in mortality and

the increase in life expectancy have been environmental, behavioral and therapeutic. They became effective from the 18th, 19th and 20th centuries, respectively, and the order in time was also the order of their effectiveness.

I conclude that the transitional period has witnessed a change in the common health problems of developed countries, from infectious to noncommunicable diseases. The decline of infections has resulted mainly from reversal of conditions which had made them predominant: deficient food supplies, uncontrolled population growth and poor hygiene. The rise of noncommunicable diseases is due largely to changes in ways of life (from those of the nomadic period) for which man's genes have not adapted.

The Future

The most important question concerning the future of man's health is whether the control of noncommunicable diseases will be achieved mainly by modification of their origins, as in the case of the infectious diseases, or by clinical intervention in disease mechanisms after they have occurred.

Before discussing this issue I will examine the nature of residual diseases that have become predominant as infectious diseases have declined. These diseases can be divided broadly into four categories, distinguished according to the feasibility and means of their control: (1) relatively intractable; (2) preventable, associated with poverty; (3) preventable, associated with affluence, and (4) potentially preventable, but not clearly related to poverty or affluence.

Relatively Intractable

The diseases in this category include the following:

- Genetic diseases. These include the rare single-gene disorders and the more common chromosomal aberrations, most of which are eliminated through spontaneous abortions. Genetic diseases, so defined, are found in less than 0.5 percent of live births and, thus, are not among the common diseases.
- Other diseases determined at fertilization. These are polygenic conditions usually manifested in late life, such as a deterioration in the functioning of eyes and ears.
- Diseases associated with prenatal environmental influences. Most types of mental subnormality and congenital malformations belong in this group. Results of both microscopic and familial studies offer no evidence that such conditions are determined irreversibly at fertilization. However, the deleterious environmental influences affect the embryos early in pregnancy, and most influences are likely to remain unidentified, at least in the foreseeable future.

In designating these diseases as relatively intractable, I am not suggesting that they offer no possibility for prevention or treatment. The withdrawal of thalidomide, the prevention of Rhesus hemolytic disease and the treatment of phenylketonuria are notable examples, quite different in kind, of successful measures in treating certain problems in this category. Nevertheless, I believe that most of these diseases will prove to be relatively intractable, and that even in the third group solutions will seldom result from control of adverse environmental influences (such as that which led to prevention of malformations caused by thalidomide and rubella).

Preventable, Associated With Poverty

Although many people in developed countries are now largely protected from health problems associated with poverty, we should not overlook their continuing importance. In much of the world they still predominate, and even in advanced countries there are sections of the population whose health needs owe more to poverty than to affluence. It is therefore necessary to assess potential advances through wider application of the traditional measures—nutritional, environmental, behavioral and therapeutic—which have led to a decline of infectious diseases.

A useful basis for this assessment is comparing health indices between different populations and between different sections of the same population. For example, in 1970 the differences between continents with the highest (Europe, 71 years) and lowest (Africa, 43) life expectancy at birth was nearly 30 years. Even better figures have been recorded for single countries such as Sweden (72.1 years for men and 77.7 years for women in 1971-1972).

There are also significant differences in health indices between countries at a corresponding stage of development. Figure 1 shows the trend of infant mortality between 1950 and 1975 in six developed countries. At the beginning of this period the highest rate (in Japan) was three times greater than the lowest rate (in Sweden); at the

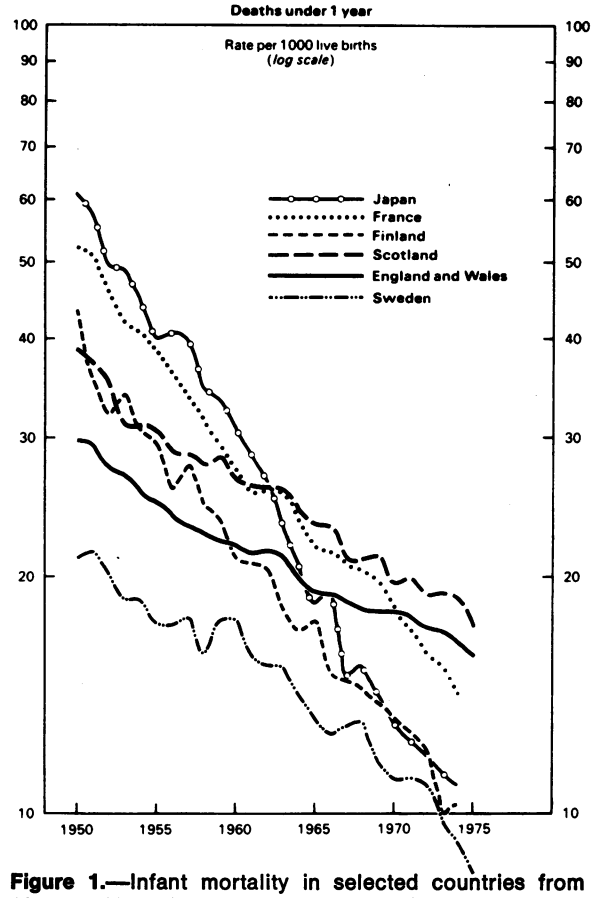

Figure 1.—Infant mortality in selected countries from 1950 to 1975. (From Prevention and Death: Reducing the Risk. London, HMSO, 1977, p 13.)

end of the period the highest rate, in Scotland, was still nearly twice that of Sweden, which was again lowest.

Much can also be learned about health problems from differences in social classes within the same country. In Britain the population is divided for statistical purposes into five classes based on the occupation of the head of the household. Figure 2 shows mortality in 1970-1972 as stillbirths, and for infants under a year, children aged 1 to 14 and adults aged 15 to 64. The relative mortality of the first two groups is expressed as death rates (per thousand total births and per thousand live births, respectively) and of the last two as standardized mortality ratios (SMR). In all four groups there is a striking increase in mortality from the wealthiest class (I) to the poorest (V).

The class differences in mortality are greatest in relation to infective and parasitic diseases and to diseases of the respiratory system. However, the differences are also substantial for malignant neoplasms, diseases of the nervous system and sense organs, diseases of the digestive system, diseases of the genitourinary system, and accidents, poisonings and violence.

Some of the variation in death rates between countries and between social classes within countries can be accounted for in other ways; for

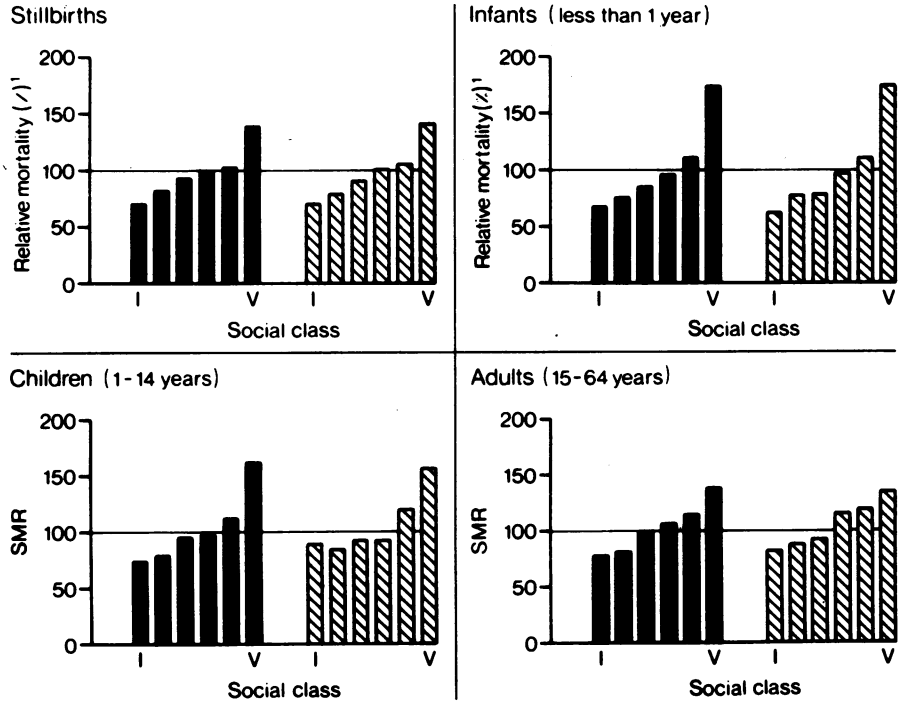

Figure 2.—Mortality by social class and age. Black and hatched bars indicate rates for 1970 and 1972 (SMR= standardized mortality ratios). (From Occupational Mortality, 1970-1972. London, HMSO, 1978, p 196.)

example, by deaths from tropical diseases in developing countries and, less certainly, by differences in behavior between classes. (There is some evidence that smoking is now more common among the poor than among the affluent, and this would increase mortality from malignant neoplasms and certain other causes of death, both infective and noninfective, in the former.) However, I think there is little doubt that differences in health experience are attributable mainly to the direct or indirect effects of poverty, and would be largely eliminated if it were possible to raise the lower standards of living and medical care to those at the highest level.

Preventable, Associated With Affluence

Under this heading I will try to identify diseases determined by behavior associated with affluence. I recognize that not all behavioral influences are associated with affluence (for example, in some poor countries people take opium), and that many health problems of an affluent society are unrelated to individual behavior (for example, the risks of asbestosis to which workers have been exposed). Nevertheless, most of the diseases determined by behavior have become prominent because of affluence and, because their solution depends on modification of personal behavior, it is important to distinguish them from the diseases of poverty which must be solved by society.

Most changes in behavior that have led to disease are comparatively recent. For example, refined foods became widely available in the early 19th century; sedentary living dates mainly from the introduction of mechanized transport, particularly the automobile, and widespread cigarette smoking has occurred only in the last few decades.

Although the relative importance of behavioral and other influences cannot be estimated accurately, it is possible to assess the ill effects of smoking. Table 1 shows the increase in life expectancy of male smokers (25 cigarettes or more per day) and nonsmokers of various ages that has occurred between the mid 19th century and today. For men aged 25, the increase for smokers has been half or less than half of that for nonsmokers. This means that the improvement in life expectancy for mature male smokers has been reduced by at least half. The fact that so large a reduction has been due to a single practice suggests that in advanced countries behavioral influences are now more important than others. And

TABLE 1.—*Statistical Estimates of the Increase in Life Expectancy of Males in the Period 1838-1854 to 1970**

Age (years)	*Nonsmokers (years)*	*Smokers† (years)*
0	31.9	26.0
25	13.2	7.0
35	10.3	4.1
45	7.4	2.1
55	4.6	0.6
65	2.3	0.3

*Based on mortality experiences of (a) British doctors, smokers and nonsmokers and (b) estimates of life expectation of men in England and Wales in 1838-1854 and 1970.

†25 cigarettes or more per day.

because these behavioral changes have arisen mainly in affluent societies, it seems permissible to conclude that diseases associated with affluence are now predominant. Hence, the order of importance of the major influences on health in industrialized nations differs from that of the past, as well as from that still prevailing in developing countries. That is, personal behavior is now relatively more significant than deficiency in food supplies or environmental hazards.

Potentially Preventable, but Not Known To Be Associated With Poverty or Affluence

Several diseases remain that do not fit into any of the preceding categories. In principle they are preventable, for there is no reason to believe that they are determined irreversibly at fertilization or that the environmental influences which lead to them are prenatal. However, they have not responded to improved conditions of life or to the advances in medicine that have led to a decline of infectious diseases, and they are not known to have arisen from the changes in behavior made possible by affluence.

They are a heterogeneous group. They include, for example, certain acute respiratory and gastrointestinal infections, many forms of mental illness, and several types of physical diseases including multiple sclerosis, rheumatoid arthritis, most cases of renal disease and a few types of cancers. Many of these conditions are undoubtedly associated with conditions of life, but it is unlikely that they clearly fall into either of the preceding classes.

The division of diseases into four categories suggests the approaches to treatment that are likely to be rewarding in future. Those referred to as relatively intractable (abnormalities determined at fertilization or in utero) are unlikely to be much affected by nutritional, environmental or behavioral changes, and the best prospects lie in

prevention of conception or birth of infants likely to be affected, or in treatment after birth. These measures depend on knowledge obtained through basic research and applied through clinical practice. Diseases in the second class, associated with poverty, can be dealt with best by the use of methods that have led to the decline of infections, such as improved nutrition, reduction of exposure, immunization and early treatment. Control of diseases associated with personal behavior made possible by affluence requires changes in behavior, a task which both individual persons and society must share.

Those conditions which seem preventable in theory, but which have neither responded to improvements in the standard of living nor appear determined by personal behavior, may cause the greatest controversy regarding the best methods of treatment. For some disorders (such as those resulting from occupational hazards), success is most likely to come from control of their origins; in others (such as the common cold) there is more hope from intervention in disease mechanisms because we are unlikely to eliminate the aggregation of populations which provides the basis for transmitting these infections. But in many diseases where neither of these approaches seems clearly the more promising, the prudent course is to investigate them both.

Medical Responsibilities

If health is determined essentially by nutrition, personal behavior and the quality of the environment, then it is clearly desirable to reconsider the role and responsibilities of medicine in relation to such influences. Indeed, this has already been done, and some have suggested that these influences are not the concern of physicians, whose work should be limited to the care and, where possible, the cure of individual patients.[6,7] From this conclusion it would follow that behavioral and environmental problems, whose solutions depend largely on economic and social measures addressed to populations, lie outside the scope of medical education.[8] It is also implied that these concerns are not among the wider responsibilties of medicine.

Because I disagree with this position I will examine three of the arguments on which it is based: (1) that for the solution of disease problems we must rely on a biomedical approach; (2) that medicine, which is concerned primarily with individual persons, has little to contribute to the understanding and control of aggregate problems, and (3) that preoccupation with such problems threatens medicine's essential function, which is to care for the sick.

First, it has been said that an approach based on laboratory science and clinical medicine offers the only hope for the solution of the major medical ills that afflict mankind.[8] This statement is patently untrue, unless the term "major medical ills" is restricted to a well-defined group of diseases. Certainly, there is one category—diseases determined at fertilization or in utero—in which only this approach offers much prospect of success, and with many diseases in the fourth group (discussed above) it is as promising as any other. But the major health problems today are largely determined by behavior in developed countries and by poverty in the world as a whole, and only in the remote future, when these problems may have been solved, might it be true to say that the biomedical approach offers the chief hope for a solution of the ills that remain. That is, if the diseases associated with poverty or a departure from the conditions under which man evolved were eliminated by control of their origins, then the residual problems would be those that must be tackled through knowledge of their mechanisms.

The second suggestion—that medicine has little to contribute to the solution of aggregate problems—should be considered in relation to both research and practice. If this view were accepted, there is little doubt that medical research would be increasingly polarized towards the study of disease mechanisms, with serious risk of neglecting disease origins. The scope of enquiry is greatly broadened when it is illuminated by clinical experience, and many examples could be cited to support the conclusion that medical interest is essential for indentification of environmental and behavioral influences on health. It was a doctor's experience of cholera that led to investigation of water supplies, clinical observations of malformed patients that resulted in recognition of the teratogenic effects of thalidomide and rubella, and a surgeon's awareness of the different disease patterns between Africans and Europeans that drew attention to the relationship of refinement of food to intestinal disease. Such advances are unlikely to come from a profession dedicated exclusively to the prevention and treatment of disease in individual patients.

When adverse influences have been identified,

their control is largely in the hands of nonmedical people. Nevertheless, I believe that medical specialists in nutritional and environmental medicine are needed, and they can hardly emerge if these subjects are excluded from medical education. Medical involvement in modification of behavior also seems desirable. It would be unsatisfactory if the major determinants of health in advanced countries were left entirely to people with little knowledge of the diseases concerned, or if approaches to controlling the subtle influences that shape health-related behavior were carried out by such ineffective means as posters and public exhortations.

But whatever the decisions about appropriate medical contributions to public activities related to nutrition, environment and behavior, physicians have an inescapable responsibility regarding behavior that affects the health of their patients. If the diet of a diabetic and the exercise of a sedentary worker who has had a coronary thrombosis are matters for the physician, so too are the smoking habits of an adolescent, if prevention as well as treatment of disease in individual persons is an accepted goal. There are many circumstances in which a doctor can say accurately: I can do more for this patient by influencing his behavior than by any treatment that can be prescribed (a possibility not considered by a general practitioner who was overheard by a medical student to say, "Don't worry about your smoking, just keep on with the tablets").

Before examining the suggestion that however desirable medical interest in the aggregate problems affecting health might be, it would prejudice a physician's primary responsibility for the care of individual patients, I must remove some possible sources of misunderstanding. First, I do not question that the care of the sick is a physician's primary responsibility and that medical education should be directed largely to that end. Second, the conclusion that the main determinants of health are likely in the future, as in the past, to lie outside the medical care system in no way diminishes the importance of the clinical function. When people are ill they want all that is possible to be done for them, and small benefits are welcome when larger ones are not available. Nor does an inability to reverse the course of established disease reduce the importance of the pastoral or samaritan role of the doctor—in some ways it enhances it.

However, the belief that wider responsibilities are incompatible with personal care results from equating the role of medicine as an institution with that of clinical practice. Certainly, a physician who treats sick people cannot be expected to deal with national food policies, changes in the environment and public attempts to modify behavior, although an understanding of these influences on health seems as relevant to his work as knowledge of the chemistry of the drugs he administers. Medicine as an institution should be concerned with such matters and with many others that lie outside the clinical role. I suggest that medicine's responsibilities might be defined as follows: To assist us to come safely into the world and comfortably out of it, and during life to protect the well and care for the sick and disabled.[5] The protection of the well and the care of the sick (in some of its aspects) cannot be achieved through services directed exclusively to individual patients.

I see no reason why additional responsibilities cannot be accepted without prejudice to the primary clinical function. A knowledge of the origins of disease should be included in medical education, for it is as basic to medicine as an understanding of natural selection is to biology; additional instruction can be provided through electives for those who wish to specialize in nutritional, behavioral and environmental medicine. I believe that medical research needs to be guided by an analysis of disease problems such as that outlined above, and would be crippled if investigation of disease origins were strictly separated from that of disease mechanisms. It is fortunate that such a demarcation was not imposed on research on infectious diseases during the past century.

In health services as well there would be many disadvantages in limiting the role of medicine to clinical practice. There would be no profession concerned comprehensively with health matters, and the division between professions dealing with the prevention and treatment of disease would be regrettable. One of the unfortunate features of contemporary professional organizations (societies, associations, colleges, faculties, and so forth) is their emphasis on sectional or regional interests. Collectively, they provide no forum for consideration of the larger issues that should be the concern of medicine as an institution.

Finally, I wish to consider briefly a few implications for clinical medicine of the conclusions drawn concerning the determinants of health. One is the need for a more critical appraisal of the

effectiveness and efficiency of medical procedures for which Cochrane has argued so persuasively.[9] Another is acceptance of responsibility for all aspects of the care of the sick, particularly that of patients—such as the mentally ill and retarded and many of the elderly—whose treatment offers no scope for active measures of investigation or cure. Finally, there is a need for increased attention to the care of patients with terminal illnesses.

There have been some interesting reactions to the conclusion that today clinical intervention cannot be expected to have much impact on the common indices of health. For example, it has been suggested that the emphasis should be switched from increasing man's life span to improving its quality; that drugs "for the relief of symptoms rather than etiology is a goal truly worthy of intensive study and originally was the only realistic goal of medicine."[10]

These views are based on the recognition that the therapeutic advances of the last few decades have had little effect on death rates, and that in developed countries we are approaching the "normal" life span which medicine cannot be expected to extend. It is possible to accept both observations without agreeing that cure, in the full sense, is no longer a realistic aim. A patient with a life-threatening illness—such as malignant hypertension, multiple sclerosis, leukemia or nephritis—wishes above all to be restored to a life of normal duration, and this goal deserves equal attention as projects to improve the quality of life. This aim is not invalidated because extension of life in such diseases cannot have much effect on either national death rates from all causes or on life expectancy at birth, as the number of people affected by these diseases is small in relation to the total population, and many illnesses occur late in life when the possible addition of years is limited. Success in prolonging life in patients with specific diseases should be assessed in relation to the number affected by them rather than to the general population.

It has also been said that the common indices of health are inappropriate to the work of a physician, that "tests of the 'outcome' which are obtainable in the public health system are seldom helpful in the personal encounter-physician system."[11] This conclusion is drawn largely from recognition of two difficulties, one of assessing the work of individual physicians and the other of separating the therapeutic aspects from other facets of care, sometimes referred to as the pastoral or samaritan role.

Recognizing these difficulties, I nevertheless think it is important to examine carefully the different components of clinical service before concluding that indices of effectiveness are inappropriate to them. All aspects of service cannot be assessed quantitatively, nor can they be dissociated from one another in the day-to-day delivery of care. But sooner rather than later, rising costs will make it necessary to introduce cost benefit evaluation, and to accomplish this it will be essential to classify clinical services according to the nature of the tasks involved.

Considering that one of the reasons given for not assessing outcome is the importance of the samaritan role, it is remarkable that the samaritan role itself is often prejudiced by lack of evidence of effectiveness. For when clinical procedures are not evaluated scientifically they are evaluated intuitively; each practitioner makes up his own mind about the usefulness of, say, radical mastectomy, tonsillectomy, cervical cytologic procedures or prolonged rest after myocardial infarction. The benefits of intervention and the associated technology are frequently overestimated and this may result in the neglect of patients after the acute phase of illness, or of those persons (such as the mentally handicapped) who provide no scope for active measures. In a recent book, *The Role of Medicine,* I have attempted an analysis of the tasks of clinical medicine under five headings—reassurance, treatment of an acute emergency, cure, care and comfort—and concluded that tests of effectiveness are appropriate in two of them (the second and third).[5]

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